

Biological Nitrogen Fixation and Yellowing in Peanuts

Peanut Field Day 2023, NFREC-Marianna

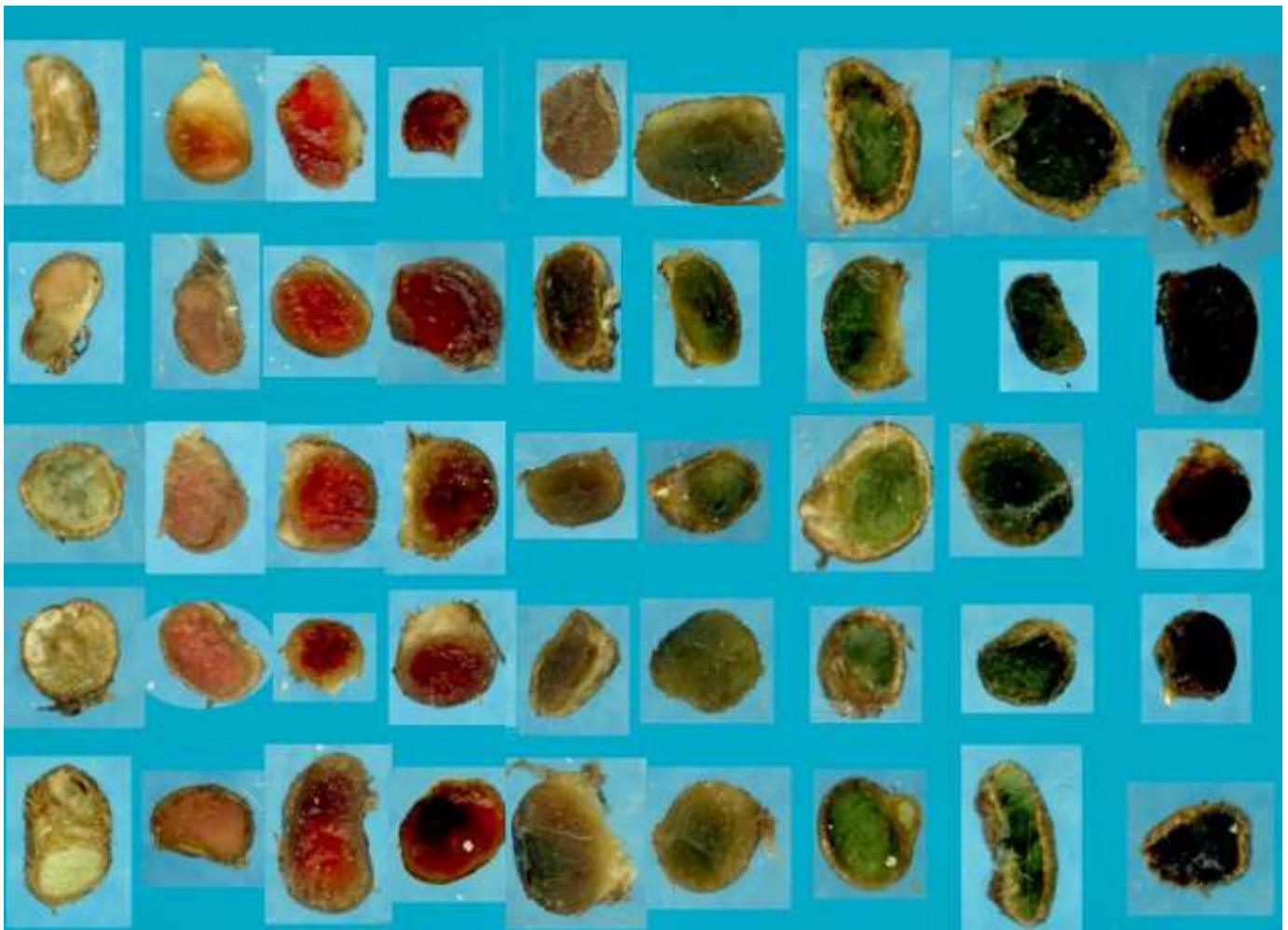
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Yellowing in peanuts can be caused by a reduction in biological nitrogen fixation or other nutrient management concerns.

Assessing nodulation or biological nitrogen fixation

“Scouting five to six weeks after planting assesses early nodulation in advance of possible decisions about applying mid-season nitrogen.”

- An average of 15 large nodules (1/8" or larger) per taproot is considered good nodulation.
- Less than 10 nodules per taproot is considered marginal and less than 5 indicates poor nodulation.



From left to right, examples of nodule internal color representing not yet active rhizobia, increasingly active, fully active, and darkening to green and black, representing senescence and decay. These individual nodules are only a few millimeters wide and are taken from scanned images used in UF/IFAS digital color analysis. (Source: *Hensley and Rowland, 2017*)

Common causes of minimal to no taproot nodulation or biological nitrogen fixation

- Poor placement of in-furrow liquid inoculant.
- Shallow planting
- Incompatibility with other products applied at planting.
- Use of starter fertilizer
- Improper handling of inoculants

Biological nitrogen fixation can be reduced due to the following:

- **Environmental**
 - **Flooding** reduces BNF because excessive soil moisture limits the available oxygen required by N-fixing bacteria to convert N₂ from the atmosphere into ammonium.
 - **Drought** limits the plant uptake of all nutrients and reduces the number and functionality of nitrogen-fixing root nodules.
- **Nutrient management**
 - **Molybdenum** and **Boron** are essential micronutrients required for healthy nodule formation.
 - **Nickel** deficiencies are rare but can reduce BNF.
 - **Phosphorus**, **sulfur**, and **cobalt** are also important nutrients required for N fixation and nodule growth.
- **Other soil management considerations**
 - The optimal range in **soil pH** for nodulation and nitrogen fixation is 5.9 to 6.3. BNF is generally reduced when soil pH is below 5.9.
 - Inadequate populations of N-fixing bacteria in a field can limit BNF. While peanuts don't always respond to inoculation, adding **inoculants** is cheap insurance. UF/IFAS EDIS publications strongly recommend using inoculants when peanuts have not been grown in that field for several years.

Non-BNF causes of peanut yellowing include sulfur deficiency, magnesium deficiency, potassium deficiency, manganese deficiency, iron deficiency, zinc deficiency, and variety selection.

Relevant Nutrient Deficiency Symptoms:

Boron: swollen leaves and nodes at the top of the plant, poor nodulation; in severe cases, can result in stem splitting and hollow hearts later in the season

Iron: interveinal chlorosis and bronzing or necrosis, especially on newer leaves

Magnesium: mottled yellowing on leaves, with some necrotic spots especially on lower leaves

Manganese: interveinal chlorosis, especially on newer leaves

Molybdenum: yellowing and poor nodule formation

Nickel: yellowing and poor nodule formation, sometimes developing into necrotic leaf tips on younger leaves

Nitrogen: overall yellowing, with more pronounced yellowing, bronzing, or even necrosis at the base of the plant

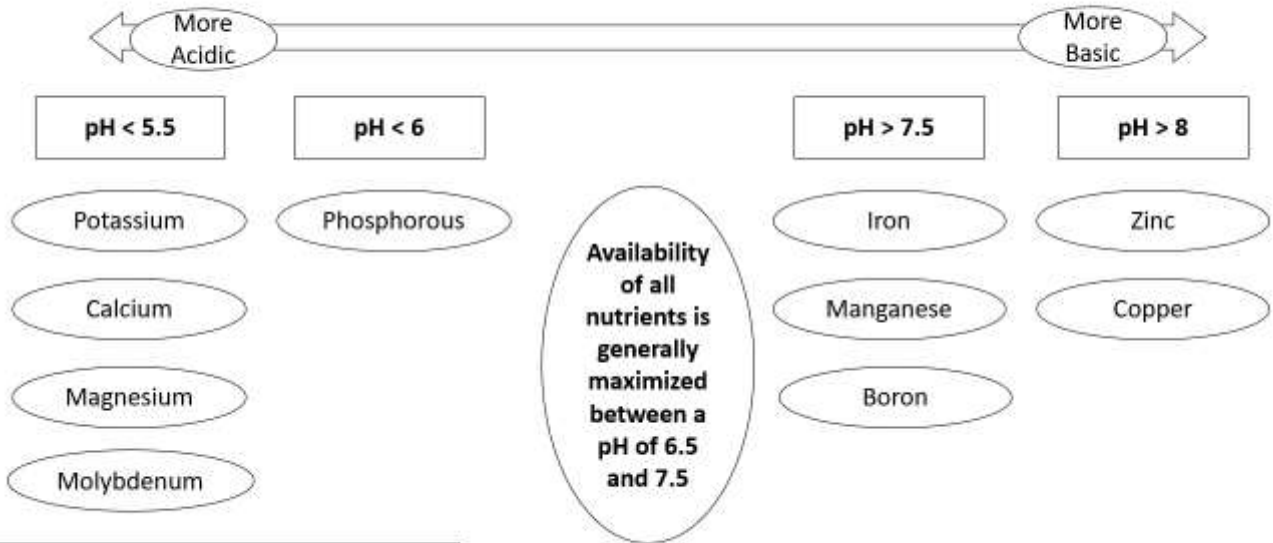
Phosphorus: stunting, few branches, poor root development, darker than normal leaves, red veins especially in the lower canopy

Potassium: yellow leaf margins, especially on leaves in the center of the canopy

Sulfur: all-over yellowing that affects leaf tissue and veins equally

Zinc: irregular, mottled yellowing that is lighter in color than other deficiencies (almost white in color), especially on newer leaves

**Potential Nutrient Deficiencies
Grouped By Soil pH**



Deficiencies that occur without regard to soil pH: Nitrogen, Sulfur

**Nutrient Deficiencies Grouped
by Most Likely Position of
Symptoms**

